EFFECTS OF PHOTOSYNTHETIC ACTIVITY IN ENDOSYMBIOTIC ZOOCHLORELLAE ON GEMMULE GERMINATION OF A FRESHWATER SPONGE, *RADIOSPONGILLA CEREBELLATA*. *Memoirs of the Queensland Museum 44: 524. 1999*:- Many of freshwater sponges thrive in oligotrophic clear waters in cooperation with photosynthetic endosymbionts, such as zoochlorellae in their mesenchymal cells. They also withstand unfavourable winter season in dormant forms as gemmules. Annandale sponge *Radiospongilla cerebellata* is a green freshwater demospongiae with zoochlorellae in their archaeocytes and flourishes only in warmer season in southern district of Japan. Gemmules of the Annandale sponge also contain zoochlorellae in thesocytes and germinate only under illumination even if all other conditions are properly provided. Although the light sufficient to induce the germination was very low in intensity and extremely short in illuminating period, photosynthesis seems to be essential for the germination, because a photosynthetic inhibitor, atrazine, strongly inhibited the germination under optimal condition.

Since gemmules of the Annandale sponge contain a rich storage of nutrients in the thesocytes, photosynthetic nutrients, produced during the incubating period under very low intensity and short length of illumination, seem to have little effect on the induction of the gemmule germination. We undertook to observe the effects of other factors on gemmule germination, that is, gaseous components such as oxygen evolved and carbon dioxide consumed by photosynthesis. To accomplish gas experiments, we devised a glass slide with a hollow chamber of $3cm^3$ sealed with a glass plate. In gas experiments, gemmules were placed in the chamber with M-medium (previously boiled to eliminate dissolved gaseous components). The chamber was tightly sealed with a glass plate and the desired amount of gas was introduced to the medium as a bubble under the glass plate. Gemmules were illuminated at 3000 lx through the glass plate by ordinal fluorescent tubes for 10hrs daily and kept at 24°C for 8 days. When gemmules were incubated in degassed medium that was tightly sealed and isolated from the atmospheric gases, no gemmules were germinated. When an air bubble was introduced to the incubating chamber by one tenth or more the volume of the incubation medium 100% germination was achieved.

Of the major elements of air, only oxygen induced germination efficiently, and brought full germination at much less quantity than the air (about one hundredth of the incubating medium in volume). On the other hand, nitrogen and carbon dioxide, showed no effects on the gemmule germination under the optimal condition. On the contrary, carbon dioxide showed strong inhibition of gemmule germination in the oxygenated or aerated media. These results show that gemmules of the Annandale sponge are induced to germinate by cytoplasmic oxygen concentration under the favourable condition, but can be substantially suppressed by carbon dioxide. Thus, it is regarded that light applied to the gemmules would initially promote photosynthesis in the symbiotic chlorellae in the thesocytes, which would absorb cytoplasmic carbon dioxide and block the initiation and/or progression of gemmule germination, and evolve oxygen that promotes gemmules to germinate. To confirm this assumption, we have tried to induce germination in darkness with fully oxygenated and carbon dioxide free media. However, no gemmules have germinated in total darkness, in spite of other optimal conditions.

The failure of germination in darkness can be understood as follows: when optimal temperature and oxygen were provided to the gemmule cells, (which had been dormant under the cold temperature), they seemed to rouse and begin to respire, and generate carbon dioxide. The carbon dioxide could not be eliminated from the cytoplasm readily, due to the lack of photosynthesis under darkness, so its accumulation in the thesocytes appears to inhibit germination of the gemmules. ❐ *Porifera, freshwater sponges, gemmule, germination, symbionts, photosynthesis, O_2, CO_2.*

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